

whereupon a cystic membrane is differentiated. As to what happens afterwards and in the interior I am sorry to say that I am unable as yet to give any account. Nevertheless it was still possible to see that the cavities of the intestines disappear, apparently owing to continued multiplication of cells, so that finally the entire contents of the cyst are composed of similar cells. I am inclined to believe that each of these cells represents a *young animal*, which, after being set free, roves about by aid of its cilia like one of the Ciliata, and by further division develops into the adult form; for I observed in the same salt-water small unicellular organisms, ciliated on the ventral surface only, yet bearing a few cirri in front. These are possibly the young forms (larvæ).—*Zoologischer Anzeiger*, xiv. Jahrg., no. 367 (13th July, 1891), pp. 230-233.

On the Growth of the Shell in Helix aspersa.

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We know that the growth of the shell in pulmonate Gastropods takes place by the formation, at the edge of the test, of a soft and diaphanous zone, which speedily hardens. I have specially studied this formation in *Helix aspersa*, L.

The epidermis which gives rise to it is particularly interesting owing to the hyaline spherical globules, $10\ \mu$ to $12\ \mu$ in diameter, which cover its outer surface. Their nature is organic; they persist on the oldest shells, and I have reasons for thinking that it is to similar formations that we must attribute the markings which are to be found on almost all the shells of the genus *Helix*.

In animals in course of growth, the thickened border of the mantle is always applied against the peristome, and the free edge of the epidermis, folded inwards, buries itself, but without any connexion with the tissues, in a very narrow cleft which runs round the whole circumference of the collar. Immediately behind this cleft, we observe beneath the epidermis a white zone bounding the mantle in its entire breadth.

The deposition of calcareous matter takes place on the internal face of the epidermis, at some distance from its margin. The origin of these products can be understood by examining sagittal sections of the collar and mantle.

The white zone, or bandelet, is a gland composed of flask-shaped cells, with very long necks, and granular contents, which bury themselves deeply in the subjacent tissue. The action of acetic acid and oxalate of ammonia discloses the presence of calcareous matter in these cells.

Behind this bandelet the mantle is clothed with a columnar epithelium, containing pigment or colourless granulations.

Immediately in front of the bandelet the epithelium invaginates to form the groove in which is lodged the free extremity of the epidermis. The bottom of the groove is occupied by an irregular plexus of cells, which, in a sagittal section, present the appearance of epithelial cells cut obliquely and extending to a greater or less distance into the connective tissue. These cells contain transparent spherules, presenting all the characters of the globules of the epidermis.

There is thus formed in the connective tissue a series of regular glandular sacs, adhering one to another. On teasing out the tissues of the living animal it is seen that these gland-cells attain considerable dimensions, and that the globules are formed at the expense of their granular protoplasm. The globules originate and grow in vacuoles, which become successively hollowed out in the protoplasmic mass, so that finally the cells are nothing more than transparent masses formed by an agglomeration of little delicate-walled alveoli enclosing the globules. The latter, on being set free, probably by simple rupture, emerge at the bottom of the groove, where they attach themselves to the fine organic membrane secreted by the epithelium.

The calcareous and mucous glands are absent, as stated by Leydig*, in all the parts covered by the shell, and I was able to prove that the calcareous glands of the collar, conformably to the opinion of Semper, do not contribute in any way to the formation of the test.

The only elements which take part in the production of the latter are, commencing from in front:—(1) The pallial groove, where is formed the epidermis with the glandular sacs, which produce the globules, and the existence and function of which I believe I am the first to describe; (2) the bandelet, or pallial gland, on which appears to devolve the secretion of the calcareous matter; (3) the pallial epithelium following the bandelet, which provides the shell with its pigment and completes its calcification by the deposition of organo-calcareous layers, homologous to the layers of nacre in the Pelecypods.

I determined, moreover, that, *when the animal has attained its full size, the bandelet and the glands with globules have completely disappeared.*

It is only the epithelium of the mantle and of the pulmonary sac which retains its activity, for the purpose of contributing to the internal thickening of the test, and also of replacing the loss of portions of it, as is shown by the following experiment, which indicates the rapidity and activity of the secretion.

If we lay bare a portion of the surface of the pulmonary sac, by removing a fragment of the shell, it is possible even at the end of an hour and a half to two hours to detach an extremely delicate organic membrane, covering the whole surface, and strewn with rhombohedral and radiating crystals of carbonate of lime. If allowed to remain, this membrane thickens very rapidly, and finally closes up the opening with a solid calcareous wall.

In no case (contrary to the statement of C. Picard †) does the mucus produced by the collar or the mouth take part in this process of reparation.

As regards the activity of the pallial epithelium, it is such that, during two consecutive months, I was able to observe animals, which were deprived of food, reproducing every day the organo-calcareous membrane which I removed every morning.—*Comptes Rendus*, tome exliii. no. 7 (August 17, 1891), pp. 317–319.

* Leydig, 'Die Hautdecke und Schale der Gastropoden.'

† Dr. C. Picard, 'Hist. des Moll. terr. et fluvi. qui vivent dans le département de la Somme,' 1840.